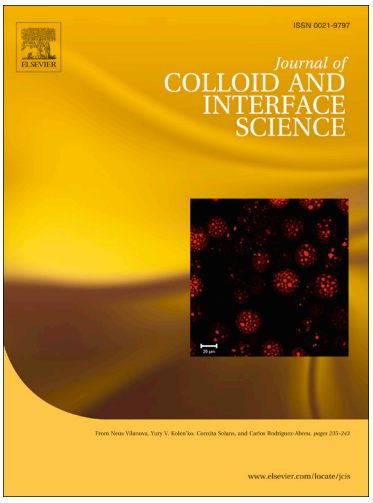

TiO_2 Nanocrystals Decorated Z-schemed Core-Shell CdS-CdO Nanorod Arrays as High Efficiency Anodes for Photoelectrochemical Hydrogen Generation

Chia-Hsun Li, Chan-Wei Hsu, Shih-Yuan Lu

PII: S0021-9797(18)30266-2
DOI: https://doi.org/10.1016/j.jcis.2018.03.024
Reference: YJCIS 23374

To appear in: *Journal of Colloid and Interface Science*

Received Date: 8 January 2018
Revised Date: 5 March 2018
Accepted Date: 7 March 2018

Please cite this article as: C-H. Li, C-W. Hsu, S-Y. Lu, TiO_2 Nanocrystals Decorated Z-schemed Core-Shell CdS-CdO Nanorod Arrays as High Efficiency Anodes for Photoelectrochemical Hydrogen Generation, *Journal of Colloid and Interface Science* (2018), doi: https://doi.org/10.1016/j.jcis.2018.03.024

TiO_2 Nanocrystals Decorated Z-schemed Core-Shell CdS-CdO Nanorod Arrays as High Efficiency Anodes for Photoelectrochemical Hydrogen Generation

Chia-Hsun Li,[a] *Chan-Wei Hsu,*[a] *Shih-Yuan Lu*[*a]

[a] Department of Chemical Engineering, National Tsing Hua University, Hsinchu, 30013, TAIWAN, ROC

E-mail: SYLu@mx.nthu.edu.tw

Abstract: TiO_2 nanocrystals decorated core-shell CdS-CdO nanorod arrays, TiO_2@CdO/CdS NR, were fabricated as high efficiency anodes for photoelctrochemical hydrogen generation. The novel sandwich heterostructure was constructed from first growth of CdS nanorod arrays on a fluorine doped tin oxide (FTO) substrate with a hydrothermal process, followed by in situ generation of CdO thin films of single digit nanometers from the CdS nanorod surfaces through thermal oxidation, and final decoration of TiO_2 nanocrystals of 10-20 nm via a successive ionic layer absorption and reaction process. The core-shell CdS-CdO heterostructure possesses a Z-scheme band structure to enhance interfacial charge transfer, facilitating effective charge separation to suppress electron-hole recombination within CdS for much improved current density generation. The final decoration of TiO_2 nanocrystals passivates surface defects and trap states of CdO, further suppressing surface charge recombination for even higher photovoltaic conversion efficiencies. The photoelectrochemical performances of the plain CdS nanorod array were significantly improved with the formation of the sandwich heterostructure, achieving a photo current density of 3.2 mA/cm^2 at 1.23 V (vs. RHE), a 141 % improvement over the plain CdS nanorod array and a 32% improvement over the CdO/CdS nanorod array.